

AMENDMENTS TO THE CLAIMS

This Listing of Claims will replace all prior versions, listing, of claims in the specification.

LISTING OF CLAIMS:

1. (Withdrawn) A system for detecting a cardiac event in a human patient the system including:

at least two electrodes for obtaining an electrical signal from the patient's heart, the electrical signal being either or both an electrogram and/or an electrocardiogram, the electrical signal consisting of a multiplicity of segments each having a time period of a specific time duration;

a device for detecting a cardiac event, the device including means for processing at least some segments of the electrical signal, the means for processing including the processing of individual beats of the patient's heart and also the sequential processing of successive beats to detect at least one abnormality within that beat, the processing being capable of determining if the beat is an abnormal beat or a normal beat; and

means for determining that a cardiac event has occurred when at least M out of N abnormal beats occur during the processing of the electrical signal before the occurrence of M-N+1 normal beats.

2. (Withdrawn) The system of claim 1 where the cardiac event is an acute myocardial infarction.
3. (Withdrawn) The system of claim 1 where the abnormality is a detected ST shift.
4. (Withdrawn) The system of claim 1 the cardiac event is an arrhythmia.
5. (Withdrawn) The system of claim 4 where the arrhythmia is selected from the group consisting of tachycardia, bradycardia, unsteady heart rate, bigeminal rhythm, premature ventricular contractions, premature atrial contractions and atrial fibrillation.
6. (Withdrawn) The system of claim 1 where the cardiac event is exercise induced ischemia.

7. (Withdrawn) The system of claim 1 where at least one of the electrodes is located within the heart.

8. (Withdrawn) The system of claim 7 where the electrode located within the heart is located within the right ventricle.

9. (Withdrawn) The system of claim 7 where the electrode located within the heart is located within the right atrium.

10. (Withdrawn) The system of claim 1 where at least one of the electrodes is located outside of the heart.

11. (Withdrawn) The system of claim 1 where at least one electrode is located on the surface of the patient's skin.

12. (Withdrawn) The system of claim 1 where at least one electrode is located subcutaneously.

13. (Withdrawn) The system of claim 12 where at least one subcutaneously located electrode is located on the patient's left side.

14. (Withdrawn) A system for detecting a cardiac event from an electrogram of a patient's heart as measured by implantable electrodes the electrogram including segments consisting of multiple beats and each beat having sub-segments, the system including:

(a) electrical circuitry means for determining the time of occurrence of a fiducial marker within the QRS complex of successive beats within the electrogram;

(b) processor means for calculating the time period between successive fiducial points, that time period being called an R-R interval, the R-R interval for a specific beat within the electrogram being the difference in time of occurrence of the fiducial point of a first beat to the time of occurrence of the fiducial point of the preceding beat;

(c) means for determining the signal amplitude of at least one sub-segment of at least one beat of the electrogram, the sub-segment having a start time and a time duration;

(d) a telemetry system for receiving sub-segment timing information from an external device;

(e) a random access memory for storing the sub-segment timing information received from the external device;

(f) wherein the processor is configured to determine the start time of the sub-segment based on the values of the calculated R-R interval and the sub-segment timing information; and,

(g) wherein the processor is configured to detect the cardiac event by further analysis of the signal amplitude of the at least one sub-segment of the at least one beat of the electrogram, and responsive to a determination that the cardiac even has occurred to send an alarm signal to an alarm device.

15. (Withdrawn) The system of claim 14 wherein the cardiac event is an acute myocardial infarction.

16. (Withdrawn) The system of claim 14 wherein the cardiac event is exercise induced ischemia.

17. (Withdrawn) The system of claim 14 wherein the sub-segment of the electrogram includes at least a portion of the ST segment of the electrogram.

18. (Withdrawn) The system of claim 14 wherein the sub-segment of the electrogram includes at least a portion of the PQ segment of the electrogram.

19. (Withdrawn) The system of claim 14 wherein the sub-segment of the beat of the electrogram includes the peak of the T wave.

20. (Withdrawn) The system of claim 14 further including means to exclude any beat where the R-R interval is shorter than a predetermined time period from the processing means for detecting a cardiac event.

21. (Withdrawn) The system of claim 20 wherein the predetermined time period is 60 milliseconds.

22. (Withdrawn) The system of claim 14 wherein the signal amplitude of the sub-segment is the average signal amplitude of that sub-segment.

23. (Withdrawn) The system of claim 14 wherein the start time of the sub-segment is adjusted in proportion to the R-R interval.

24. (Withdrawn) The system of claim 14 wherein the start time of the sub-segment is adjusted in proportion to the square root of the R-R interval.

25. (Withdrawn) The system of claim 14 wherein the sub-segment timing information has the form of a look up table with sub-segment start times accessed according to R-R interval.

26. (Withdrawn) A cardiac pacemaker with the capability of detecting a heart attack in a human patient the pacemaker including:

electronic demand pacing circuitry designed to pace the heart of the human patient when the R-R interval exceeds a pre-determined time period;

a pacemaker lead placed within the heart of the patient, the lead providing an electrogram signal to the electronic demand pacing circuitry;

electronic circuitry for detecting a shift in a specific sub-segment of the electrogram signal, the electronic circuitry including timing means to identify the start and time duration of a sub-segment for each beat within the patient's electrogram signal, the timing means having at least two sets of parameters used to calculate the start time and duration of the sub-segment, a first set of parameters for detecting a shift in the specific sub-segment of the heart beat for heart beats that are not triggered by the electronic demand pacing circuitry, and a second set of parameters to be used for detecting a shift in the specific sub-segment of the heart beat for heart beats that are triggered by the electronic demand pacing.

27. (Withdrawn) The system of claim 26 where the sub-segment is the ST segment.

28. (Withdrawn) The system of claim 26 where the sub-segment includes the peak of the T wave.



29. (Withdrawn) The system of claim 26 where start time of the sub-segment is calculated relative to the time of occurrence of the R wave.

30. (Withdrawn) The system of claim 26 where start time of the sub-segment is calculated relative to the time of occurrence of the S wave.

31. (Withdrawn) The system of claim 26 where start time of the sub-segment is calculated relative to the time of occurrence of the S wave on beats where the pacemaker is pacing and relative to the R wave on beats where the pacemaker is not pacing.

32. (Withdrawn) The system of claim 26 further including alerting means to notify the patient when a heart attack is detected.

33. (Withdrawn) The system of claim 32 further including means to detect exercise induced ischemia and heart arrhythmias.

34. (Withdrawn) A system for detecting a cardiac event in a human patient, the system including:

at least two electrodes implanted in the patient for obtaining the electrical signal from the patient's heart, the electrical signal being an electrogram;

an implanted cardiosaver including electronic circuitry designed to identify at least one feature of a beat of the electrogram by comparing the slope of the electrogram signal with a first predetermined threshold if the slope of the electrogram signal is positive and a second predetermined threshold if the slope of the electrogram signal is negative.

35. (Withdrawn) The system of claim 34 where the electronic circuitry includes a microprocessor.

36. (Withdrawn) The system of claim 14 wherein the fiducial is the peak of the R wave within the QRS complex.

37. (Previously Presented) A system for assessing cardiac function based on the electrical signal from a patient's heart as measured by implantable electrodes, the electrical signal including segments consisting of multiple beats, the time period

between QRS fiducial points of successive beats being called an R-R interval, the system including:

- (a) means for receiving a first plurality of user selected offset times associated with a corresponding plurality of R-R intervals;
- (b) electrical circuitry means for determining R-R intervals;
- (c) processor means for determining a first particular offset time relative to a beat fiducial point of one beat of the electrical signal, wherein the first particular offset time is a function of an R-R interval associated with the one beat, and wherein the first particular time offset is based on at least one of the first plurality of user selected offset times; and
- (d) processing means for assessing cardiac function based upon the amplitude of the electrical signal at a sample defined by the beat fiducial point and the first particular time offset.

38. (Previously Presented) The system of claim 37 wherein the QRS fiducial points are R wave peaks.

39. (Previously Presented) The system of claim 37 wherein the beat fiducial point is within a QRS complex.

40. (Previously Presented) The system of claim 39 wherein the beat fiducial point is an R wave peak.

41. (Previously Presented) The system of claim 37 wherein the sample defined by the beat fiducial point and the first particular time offset is within an ST segment.

42. (Previously Presented) The system of claim 37 wherein each of the first plurality of user selected offset times is associated with a corresponding range of R-R intervals.

43. (Previously Presented) The system of claim 37 wherein the first particular offset time is based on only one of the first plurality of user selected offset times that corresponds to the R-R interval associated with the one beat.

44. (Previously Presented) The system of claim 43 wherein the first particular offset time is equal to the one of the first plurality of user selected offset times that corresponds to the R-R interval associated with the one beat.

45. (Previously Presented) The system of claim 37 wherein the system includes:

(e) means for receiving a second plurality of user selected offset times associated with a corresponding plurality of R-R intervals;

(f) means for determining a second particular offset time relative to the beat fiducial point, wherein the second particular offset time is a function of the R-R interval associated with the one beat, and wherein the second particular time offset is based on at least one of the second plurality of user selected offset times; and

(g) processing means for assessing cardiac function based upon the amplitude of the electrical signal at samples defined by the beat fiducial point and the first and second particular time offsets.

46. (Previously Presented) The system of claim 45 wherein the first particular offset time is associated with the start of a subsegment of the electrical signal, and wherein the second particular offset time is associated with the end of the subsegment.

47. (Previously Presented) The system of claim 46 wherein each of the first plurality of user selected offset times corresponds to the subsegment start time, and wherein each of the second plurality of user selected offset times corresponds to the subsegment duration.

48. (Withdrawn) The system of claim 14 wherein the fiducial.